

Oceaneering Applies Photogrammetric Technology for Dimensional Control Surveys of Complex Spool Pieces

Photogrammetric methods provide an efficient, cost-effective, safe, and reliable alternative for rapid delivery schedule required by survey operations in Angola



Project Overview

In May 2022, and as part of a long-standing contract with a major operator, Oceaneering was tasked with completing dimensional control surveys for three complex spool pieces. Noting the challenging geometry of the assets, the customer expressed an interest in a photogrammetric solution. After review of the project requirements, detailed photogrammetric task plans were formulated and a local team

of Oceaneering surveyors in Angola carried out all field preparations and the acquisition of comprehensive, convergent/overlapping imagery necessary for each asset. A globally networked team of specialists then performed fully analytic photogrammetric data processes that resulted in the determination of the precise relative position and orientation of key spool features which were compiled and reported to the client.

Challenge

Dimensional control survey data for a given spool enables an operator to evaluate conformance with design/fabrication specifications and readiness for subsea deployment. In this case, the spool consisted of a 30cm diameter pipe nearly 100 meters long with multiple bends and deflections. This proved to be a complex surveying challenge.



The Oceaneering Solution

The Oceaneering Survey team has successfully used photogrammetric techniques for dimensional control surveys of smaller, more symmetric structures (i.e., well trees, valves, etc.). A photogrammetric approach was chosen for this project due to the advantageous delivery of both precise photo-triangulated coordinates of the structure, as well as the extraction of dimensional data from a dense point cloud for those features less well-defined or accessible conventionally (i.e., hub circumferences, pipe diameters, bend radii, etc.). This method provided for the acquisition and delivery of high-quality data, quick turnaround, and reduced HSSE exposure based on the use of off-the-shelf photographic equipment in a relatively remote location.

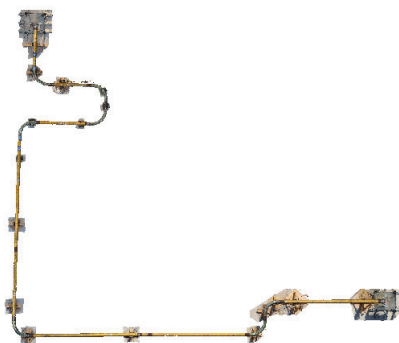
Execution Plan

Photogrammetric specialists in the UK and US have developed standard operating procedures for field preparation and image acquisition, camera calibration, and general image processing. Project-specific task plans were tailored to the circumstances presented by the spool piece geometry. These plans provided step-by-step directions for the configuration and use of the camera system, the placement and distribution of coded targets and scale bars, as well as a detailed image acquisition plan to ensure that the number, distribution, and location of camera stations provided sufficient coverage and overlap.



The result of this phototriangulation process was the simultaneous computation of the position and orientation of each camera station (their External Orientation, or EO) and position of the coded targets and other pass-points in 3D object space. From this framework, precise measurements of the spools were made, and a dense point cloud of the entire spool created.

The Angolan surveyors exercised great care in field preparation and image data acquisition. This entailed the management of overview and close-range feature collections (and associated calibration imagery) at different focal lengths/object distances. As acquisition proceeded, the remote team reviewed the imagery in near real time to confirm suitability and obtain additional acquisition if required. This collaborative approach ensured the collection of complete and high-quality source imagery.



Results

The above process provided the client with an efficient, cost-effective, and timely solution to a complex dimensional control problem. Final deliverables included a detailed report, summary tables of position and orientation values for key spool features, dense point cloud data for the entire spool extent (ASCII XYZ point coordinates with RGB color values), and orthophoto map (TIF format).